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CLAIMS

What is claimed is:

- 1 1. A method for producing a resistive element comprising the steps of:
2 depositing a seed layer over a first electrode; and
3 depositing an insulating barrier layer over the seed layer wherein the barrier
4 layer is thin enough to allow a tunneling current to flow to a second electrode;
5 wherein the resistive element comprises a resistance that is a function of the thickness
6 of the insulating barrier layer.
- 1 2. The method of claim 1 further comprising the step of depositing a
2 smoothing layer of Ta over said first electrode prior to depositing said seed layer.
- 1 3. The method of claim 1 further comprising the step of oxidizing the
2 insulating barrier layer.
- 1 4. The method of claim 1 further comprising the step of patterning the
2 resistive element such that the resistive element has a predetermined resistance value.
- 1 5. The method of claim 1 wherein the step of depositing a seed layer over a
2 first electrode further comprises depositing a seed layer of CoFe.
- 1 6. A method of producing a resistor for use in a semiconductor device, said
2 method comprising:
3 depositing a base layer over a metal contact point;

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4 depositing a seed layer over the base layer;
5 depositing a barrier layer over the seed layer; and
6 depositing a non-magnetic metal layer over the barrier layer.

1 7. The method of claim 6 further comprising the step of depositing a
2 protective cap layer over the non-magnetic metal layer.

1 8. The method of claim 6 further comprising the step of patterning the resistor
2 such that the resistor has a desired resistance value.

1 9. The method of claim 6 further comprising the step of oxidizing the barrier
2 layer.

1 10. The method of claim 9 wherein the barrier layer is oxidized with an
2 oxygen plasma.

1 11. The method of claim 6 wherein the step of depositing a seed layer over of
2 the base layer comprises depositing a seed layer of CoFe over the base layer.

1 12. The method of claim 6 wherein the step of depositing a base layer over a
2 metal contact point comprises depositing a base layer containing Ta over a metal
3 contact point.

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1 13. The method of claim 6 wherein the step of depositing a barrier layer over
2 the seed layer comprises depositing a barrier layer of Al over the seed layer.

1 14. The method of claim 6 wherein the step of depositing a non-magnetic
2 metal layer over the barrier layer comprises depositing a layer of Al over the barrier
3 layer.

1 15. The method of claim 6 wherein the step of depositing a barrier layer over
2 the seed layer comprises depositing a barrier layer less than approximately 2
3 nanometers thick over the seed layer.

1 16. The method of claim 6 further comprising depositing a smoothing layer of
2 Ta over said base layer.

1 17. A resistive element for use in a semiconductor device, said resistive
2 element comprising:
3 a base layer positioned over a metal contact;
4 a seed layer positioned over the base layer;
5 a barrier layer positioned over the seed layer; and
6 a non-magnetic metal layer positioned over the barrier layer.

1 18. The resistive element of claim 17 further comprising a protective cap layer
2 positioned over the non-magnetic metal layer.

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1 19. The resistive element of claim 17 wherein the barrier layer has been at
2 least partially oxidized.

1 20. The resistive element of claim 17 further comprising a smoothing layer of
2 Ta positioned over said base layer.

1 21. The resistive element of claim 17 wherein the base layer further comprises
2 TaN.

1 22. The resistive element of claim 17 wherein said seed layer further
2 comprises CoFe.

1 23. The resistive element of claim 17 wherein said non-magnetic metal layer
2 further comprises Al.

1 24. A resistor comprising:
2 a top electrode formed from one of a magnetic and non-magnetic metal;
3 a bottom electrode formed of a non-magnetic metal; and
4 an insulating layer positioned between said bottom electrode and said top
5 electrode wherein said insulating layer is thin enough to allow a tunneling current to
6 be established between said top electrode and said bottom electrode.

1 25. The resistor of claim 24 wherein said insulating layer further comprises a
2 thin layer of oxidized Al.

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1 26. The resistor of claim 24 wherein said insulating layer further comprises a
2 seed layer of CoFe.

1 27. The resistor of claim 24 further comprising a smoothing layer of Ta upon
2 which said insulating layer is deposited.

1 28. The resistor of claim 24 wherein said bottom electrode comprises TaN.

1 29. The resistor of claim 24 wherein said top electrode further comprises at
2 least one of Al and TaN.

1 30. The resistor of claim 24 wherein said insulating layer is less than
2 approximately 2 nanometers in thickness.